

3 Claims, 9 Drawing Figures

FIELD OF THE INVENTION (技術領域)

This invention employs a MEMS(Micro-Electro-Mechanical Systems) structured sensor and controlling techniques to make an automated directional signal light that can respond not only to LED blinking ,but also to laser blinking. This object is a microcontroller (MCU) peripheral technologies for processing multi-axes motion-sensor applications, which are in the bicycle. In data acquisition, MCU processing speed and power-consumption requirements for MEMS motion-sensor applications, as will techniques for calculating tilt angles and acceleration. All this are done through the use MCU firmware libraries and algorithms to design MEMS motion-sensor applications.



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BACKGROUND OF THE INVENTION (發明背景)

This invention relates to improvement in bicycle automated directional signal for enhanced protection of cyclists on the roads when they are turning left or right. The objective of the invention is to provide a novel automatic Left/Right device which can be attached to a bicycle and creating a virtual parallel lane. This makes the cyclist more prominently visible on the street especially in the night. This gives approaching vehicles a clear visual guide to ensure that they stay well clear of the cyclist at night.

The red LEDs having sufficient brightness and efficiency, are employed on the bicycle tail lamp, together with the combination of the Eye-Safe invisible laser (Class II laser). The two red laser light are on 635nm wavelength frequency. Besides acting as a rear warning light, It will also project a virtual parallel lane behind the cyclist making the cyclist more prominent at night from vehicles.

Present bike warning light devices comes equipped with wires , connecting a switch to the rear lighting device. However, drawbacks of such devices are losing awareness of the surroundings while cycling. The wires might cause the cyclist to trip or entangle to other stuffs.

Moreover, there will be future applicable uses on this invention, (etc in skiing or snowboarding) , the warning light mechanisms can serve as safety light for people around the user. This invention has a working temperature of -10° to 50°.

SUMMARY OF THE INVENTION (發明概要)

The invention possesses numerous benefits and advantages over other known system. In particular, the invention utilizes a turning angle which triggers the automation activation of the laser and LED lights. This provides highly visible bright automated laser and LED lights, during the event of turning left/right instead of having to rely on your arms. Besides, one characteristic of this device is combining LED lights and laser lights into a system. The system includes a motion sensor to which drive the MCU to give command to 8-LED and 2-laser diode. The ADC converts the analogue signal to digital value. MCU is used to calculate the angle from the phase of sensor signal. So the turn left/right signal about Laser and LED can be receive(obtain) by this way.

Using the MCU controls angle with the software, angle that is more than 6degrees will trigger the left/right directional blinking red laser light lanes. We are able to utilize software to change set this angle of inclination through the MCU, when the motion sensor detect the different slope angle, the 2 laser light beam will have responding information.

When system detect the right incline within 6 to 30 degrees, the right laser line will show "blinking state", same as for the left laser line when turning left. Meanwhile, the LED has "six-LEDs" to blinking (look like a right arrow) also performed by MCU. They are also the directional indicators when the bicycle is negotiating left or right turns. Another safety device is laser beam auto power off when left/right incline over 30 degrees.

The 2 red laser diodes provide two visible red laser light lanes. By using the optic structure system, we are able to project a visible 0.8m laser line width and laser line length of 1.5m based on a 635nm optical wavelength. Laser line has a visibility distance of approximately 10m. This optical structure system also possesses a temperature controlled circuit that ensures the lasers are able to operate in minus 10 to plus 50 degrees (-10°~50°) temperature range.

BRIEF DESCRIPTION OF THE DRAWINGS (圖式簡單說明)

FIG.1 shows a side view of this invention. Unit1 is an exemplary apparatus which installed on bicycle.

FIG.2 shows the control flowchart of the embodiment. This functional diagram shows Laser driver power is used when the bicycle is in motion and battery power when stopped.

FIG. 3 is the 3D structure diagram of this invention object system.

Unit 10 is a main body.

Unit 20 is a motion sensor.

Unit 30 is laser lighting device which 2-red laser diodes provide two visible red laser light lanes.

Unit 40 is a LED device of 8-LEDs.

Unit 50 is a main control circuits.

Unit 51 is a micro-controller (MCU)

Unit 60 is a power.

Unit 61 is a button switch of power.

Unit 70 is a fixing device.

FIG. 4 is an exploded perspective side view of hardware platform with the automated directional light device in position thereon, and indicating particular account positions of the light device.

FIG. 5 is an elevation detail view similar to that of FIG.3, but on an enlarged scale showing the base schematic of the device. The profile drawing of hardware platform which reveal Laser/LED device of the invention which is used to drive the MCU in the charging circuit (please refer FIG.7)

FIG.6 is a circuit diagram of the M-Sensor20 device which is contained on circuit board shown in perspective in FIG.5.

FIG.7 is a simplified electrical schematic diagram revealing the features of main control circuits of the invention. This circuit which drive the micro-controller (MCU) to give command LEDs and laser diodes.

FIG.8 is the Printed Circuit Board (PCB) layout of main control circuits50 for a specific purpose.

50-top is the top view of the PCB.50-bot is the bottom view of the PCB.

FIG.9 is a flowchart of a particular embodiment of a main routine for the automatic directional control system. The system procedure is shown following chart.

100 – threshold setup and turn on the power

101 – obtain after incline and acceleration-function signal from sensor detect (which select one among all regular lighting modes)

- 102 – first-level signal judgment(no incline and no acceleration judgment)
- 103 – the bike is in regular motion(acceleration or stable speed),and control circuits unit sends command signals as appropriate to the Laser/LED lighting device.(8-LEDs revolving flashing and 2-Laser lines lighted)
- 104 – second-level signal judgment(regular motion/ angle judgment) incline detected
- 105 – the bike is motion, and control circuits unit outputs command signals as appropriate to the lighting device. (6-LEDs show director arrow and 1-Laser line of director blinking)
- 106 – third-level signal judgment(regular motion/ angle judgment) incline detected
- 107 – the bike is in regular motion, and control circuits unit sends command signals as appropriate to the lighting device.(4-LEDs show the straight lighted and 2-Laser lines off)
- 108 – four-level signal judgment(regular motion/deceleration judgment) brake detected
- 109 – the bike is still, and control circuits unit sends command signals as appropriate to the lighting device.(8-LEDs keep lighting 7 seconds and 2-Laser lines lighted)
- 200 – press power button to turn off the engine
- 201 – put an end to this system.

DETAILED DESCRIPTION OF THE SYSTEM (發明詳細說明)

In the following descriptions and explanations, reference is made for a more comprehensive and detailed understanding, please see following descriptions and explanations for a preferred embodiment with reference to FIG.3,4, and 5. The invention of a automatic bike directional blinking light comprises: a main body 10, a motion sensor 20, a laser lighting device 30, a LED device 40, a control circuit (PCB layout) 50, a power 60 and a fixing device 70. The main body comprising a hollowed body base 11 and a cover 12, is used to contain and protect the laser lighting device 30, MCU unit 51, and LED lighting device 40. Unit 61 is a power button switch.

Referring to FIG.4 the preferred embodiment is assembled from two plastic molded pieces 11 and 12 which are glued together at their edges 13 to enclose a printed circuit board 50 and components. Two Laser light line shine through a window area 31, it also to cover laser diode. Laser diode is further seen to have two hold which are at an inclination of approximately 10° with the central section.

This M-sensor chip 20 provides SPI (4-wire) and I2C digital interface and interrupts signals with build-in functionality. Besides, three direction motion detection (high-G) with configurable logic combination and threshold setting. This motion sensor is MEMS-structured and chip-shaped, which outputs a mixed signal of direction slope angle and turn Left/Right conditions of bikes to the MCU unit 51 for further analysis. If sensor detect angle inclined is more than 6 degrees and the bike inclines to the left within 6 to 30 degrees, then the motion detection would output a signal to contact (request) left laser beam show "blinking state", same as for the right laser line when turning left.

FIG.8 is the PCB (Printed Circuit Board) layout of main control circuit 50 which comprises an M-sensor 20 and a micro-controller 51, which can store software information to control the system. The power switch 61 is electrically connected with the M-sensor, the lighting device 30/40 and the battery 60. Setting pre-programmed inside the software of the micro-controller comprises of the following: several regular lighting modes that work during motion condition. When switch turn on, 8-LEDs revolving flashing light and Laser line lighted. For directional signal mode: LED shows director arrow light, meanwhile, one side of Laser light blinking. Another brake light mode: 8-LEDs keep lighting 7 seconds that works when micro-controller judges that sensor (incline detect) are activated, a angle threshold used to determine if the bicycle is in motion to change direction, and one deceleration threshold used for comparison to determine if bicycle braked.

The sensor 20 functions comprise of the following: setting the incline angle threshold of software to select one of the regular lighting modes. By the receipt of incline signal and signal processing, the control circuits unit 50 commands the Laser device 30 and LED device 40 to give off lights. When the sensor chip detects the different slope angle that is more than 6 degrees will drive the left/right directional blinking light mode. For example, detect the right incline within 6 to 30 degrees, the right laser light will show "blinking state", same as for the left laser line when slope left.

For better functionality, the system further suggests multiple angle thresholds to ensure cyclist of their personal safety. The bigger angle of inclination threshold trigger the safety mode which enforce shut the laser device and shows "-" shape blinking lighted with 4-LEDs when detected slope angle over 30 degrees.

Regarding to detecting left/right turning status, the left or right directional signal threshold is set to compare with the changing angle of the signal. Setting original angle threshold is minus 6 degrees to plus 6 degrees input software of mathematics. If the changing angle is greater than +6 degrees, then it can be judged that bike is turning right, not the case smaller than -6 degrees is left. Another benefit of detecting left/right turning status is to make laser device power-off function possible. This safety incline range is minus 30 degrees to plus 30 degrees.

In the future lighting device 40 could be LED or regular lamps. The power60 could be batteries, dynamo, solar power, or other possible power source, and is supplying electricity to the motion-sensor 20, the control circuits unit 50 and the lighting device30/40. The fixing device 70 is a braced and a rubber band, or screws to fix the light on the applied bike.

Having described the invention, what is claimed is:

1. An automated directional bike light device comprising of the following : a micro-controller that to combine Laser lighting device and LEDs lighting device that receives commands to drive lights at a mode as appropriate. An M-sensor that is MEMS-structured, chip-shaped and employed to detect incline conditions of the bicycle. a control circuits unit that is electrically connected to the said M-sensor .The lighting modes (the left/right directional blinking light mode)employed software to process information from the M-sensor and then gives appropriate commands to the Laser/LED lighting device; its features mainly comprises : a control circuits unit has a angle of inclination function that different slope angle signals coming from the M-sensor, and can judge if the bike is turning left or right, and based on detection of inclination from the M-sensor.(detect incline within 6 to 30 degrees)
2. This automated brake light relies on a three-axis M-sensor to determine whether the bike is slowing or coming to an abrupt stop.
3. Besides, the main control circuit unit has another auto power-off function that activates when the bike falls to the ground. This automated safety feature shuts the laser device simultaneously shows"- " shape blinking lighted with 4LEDs when incline angle over 30 degrees.